Decrease in Serum Cholesterol with Surgical Stress

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• **Serum cholesterol levels decreased with the stress of operation, before the procedure or after it, or before and after. This decrease was 17.6 per cent in a group of 28 elective surgery patients and 20.4 per cent in nine ruptured intervertebral disc patients who had an operation. A presurgical drop was noted and considered to be related to psychological stress.**

SEVERAL REPORTS have appeared correlating stress with increases in serum cholesterol levels in man* In them the investigators speculated on the relationship of stress and cholesterol increases to the etiology of atherosclerosis. The stress studied was mental tension in students during examinations or in men during periods of increased occupational activity typical of some seasonal businesses. In contrast, decreases in serum cholesterol have been correlated to the stress of surgical operation[7,8] and myocardial infarcts.[1,6] In these studies adequate control levels before the stress were lacking, for it was not feasible to obtain pre-infarct values and the surgical study used reference values from specimens taken just hours before operation.

The present study was undertaken to evaluate cholesterol changes with surgical operations under more adequate control conditions.

METHODS

Previous data noted in a report on myocardial infarcts by Kellogg[6] suggested a further inquiry into serum cholesterol changes in selected stress situations. Two series of male patients were studied. One was made up of 28 patients who were admitted to hospital for elective surgical operation several days before the day set for the procedure. Two or more specimens of serum were obtained before operation and one specimen on the morning of operation. Cholesterol determinations then were done on two or more specimens up to eight days after operation.

The other group was composed of 21 patients admitted with a diagnosis of ruptured intervertebral disc. This group was of particular interest, for the patients were put in hospital for bed rest, observation and possible surgical operation, thus providing for control levels over a period of two to three weeks. These patients also presented the opportunity to examine the effect of mental stress before operation, since the decision regarding surgical intervention was not made until the results of conservative treatment were evaluated.

The second group naturally divided into those who did not have operation (12 patients) and those who did (nine patients). The total period of observation averaged about 20 days for those who were not operated upon and about 30 days for those who were. Six to 17 specimens of blood taken before breakfast were collected from each patient. Cholesterol analysis was done by the method of Kanter and co-workers.[5]

RESULTS

Twenty-seven of the 28 patients with elective operations showed a decrease in serum cholesterol levels—all but one having some decrease before and all but six some further decrease after operation. Twenty-three of them had maximum decrease of more than 10 per cent of initial levels. The average decrease was 17.6 per cent with a range of 5 to 40 per cent. Changes from initial levels to the morning of operation, as well as changes from the immediate preoperative levels to the postoperative minimum, were also analyzed. During the preoperative period the serum cholesterol level of 26 patients decreased an average of 12.4 per cent. Sixteen of these had a decrease of over 10 per cent from control levels. Twenty-one patients had additional decreases after operation, the average decrease being 9.2 per cent.

Chart 1, line A, shows the curve of average values with the day of operation as zero time. Since all samples were not taken on the exact day in reference to the day of operation, some grouping or rounding of the time scale was employed. That is, data from samples collected on the sixth, seventh or eighth day were grouped for average calculations and graphed as the seventh day point. The −1, 0 and +1 day values were taken on the day before operation, on morning of operation and the morning following operation. This group of 27 patients consisted of five having hemorrhoidectomy, 14 having herniorrhaphy, two removal of varicose veins, two abdominal perineal resections, one removal of thy-

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*References 2, 3, 4, 10, 11.

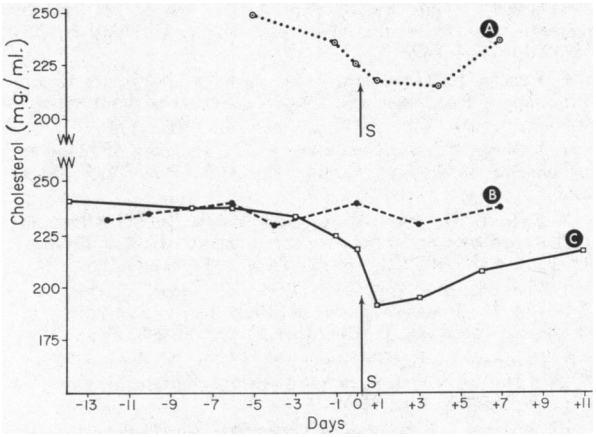

Chart 1.—Serum cholesterol changes with surgical stress. Line A, average total cholesterol values of 28 patients admitted for elective operation. Line B, average values of 12 patients with intervertebral disc disease who did not have operation. Line C, average serum cholesterol on nine patients with disc disease who were operated upon. Surgical operation (S) was performed at day 0.

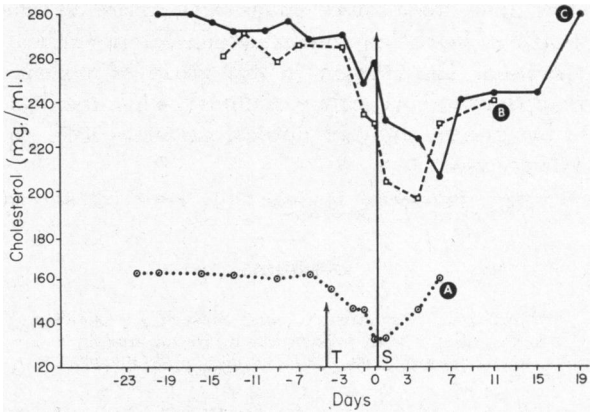

Chart 2.—Changes in serum cholesterol in three persons who had intervertebral disc operations. Day 0 is the day of surgical operation (S). The time (T) that patients were told of the decision to operate was four days before the day of operation.

roid nodule, one removal of pilonidal cyst, one pyloroplasty and one thyroidectomy. Careful examination of the cholesterol changes showed no correlation with the type of anesthesia or operation.

The 12 patients admitted for observation of possible ruptured intervertebral disc who did not have operation showed some variation in average cholesterol levels (Chart 1, line B). The maximum change in these averages was 5 per cent, although individual variation was greater than this. There was no evidence of any change in these averages that could be related to hospital diet, major periods of bed rest or the stress of indecision about surgical intervention.

The nine patients who did have operation (Chart 1, line C) had an average presurgical decrease of 9 per cent in serum cholesterol levels. There was an additional decrease of 12.8 per cent immediately after operation, which was followed by a gradual increase to a level that was still below initial levels at 11 days after operation. In some patients the initial decreases were as early as four days before operation, at the time they were told of the forthcoming procedure. The data in Chart 2, line A, concern a patient with a very stable cholesterol level during the control period and a clear decrease at the time he was told an operation was to be performed. Lines B and C of the chart show the cholesterol changes in two other patients with decreases before operation, then a further decrease after operation.

DISCUSSION

Serum cholesterol levels decreased with the stress of surgical operation, either before or after operation or before and after. The two groups of patients who had operations showed average total decreases in cholesterol of 17.6 per cent and 20.4 per cent. The initial group of patients was observed for periods up to one week before operation. This short control period might not reveal the effect of such factors as bed rest and hospital diet. The second group of patients was observed for two to three weeks before they were operated upon. This period of time provided for better control levels. However, the longer observation time did not reveal significant changes in cholesterol levels with hospitalization and its attendant changes in the patients' routine.

The stress of operation was both psychological and physiological. The psychological stress of anxiety in anticipation of operation was accompanied by an initial decrease in cholesterol. This varied with the individual, some responding with a decrease immediately upon being told of the decision to operate; in others this change occurred 24 hours before operation. No change in diet or preoperative medication had been initiated up to this time. The physiological stress of the operation was followed by an additional cholesterol decrease—a decrease that occurred under stress conditions relating to the integrity or survival of the body. In contrast the increases in cholesterol previously reported occurred with stresses more related to social status and recognition of success in society.

Peterson and co-workers[9] presented cholesterol changes in response to stress, wherein the students observed were grouped according to the stability of their serum cholesterol levels. This study included five "labile" students who showed changes related to mental stress. A consistent serum cholesterol decrease was correlated with a previous period of apprehension. An increase in cholesterol occurred before an anticipated exposure to cold. It is not

clear how these observations may relate to the decreases in cholesterol that occur before surgical operation. The changes in this group of students were transitory (hourly variations), while the data in the present study in surgical situations were on a daily basis.

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